

# INSTALLATION MANUAL

## R-22 OUTDOOR SPLIT-SYSTEM HEAT PUMP

MODELS: 13 SEER - YMB / HC3A / HL3A SERIES  
1.5 TO 5 TONS



Certification applies only  
when the complete  
system is listed  
with ARI.



ISO 9001  
Certified Quality  
Management System

### TABLE OF CONTENTS

GENERAL 1 .....	EVACUATION .....	7
SAFETY .....	SYSTEM CHARGE .....	7
UNIT INSTALLATION .....	SYSTEM OPERATION .....	9
INSTALLATIONS REQUIRING TXV .....	INSTRUCTING THE OWNER .....	18
ELECTRICAL CONNECTIONS .....	WIRING DIAGRAM .....	20

### LIST OF FIGURES

Typical Installation .....	2	Demand Defrost Control Module .....	8
Oil Trap .....	3	Defrost Operation Curves .....	13
Tubing Hanger .....	3	Hot Heat Pump Indoor Airflow Control .....	14
Underground Installation .....	3	Jumper Inputs .....	15
Heat Protection .....	4	Wiring Diagram .....	20
Typical Field Wiring .....	6		
CFM Selection Board .....	7		
Heat Pump Flow Diagram .....	8		

### LIST OF TABLES

R-22 Saturated Properties .....	8	Air Handler Auxiliary Heat Functionality .....	16
TEST Input Functionality .....	9	Fossil Fuel Furnace Auxiliary Heat Functionality .....	16
Operational Mode Display .....	9	1-1/2 Ton Subcooling Charging Chart .....	18
Status Code Display .....	10	2 Ton Subcooling Charging Chart .....	18
X/L Output Categories .....	10	2-1/2 Ton Subcooling Charging Chart .....	18
Operational Fault Codes .....	10	3 Ton Subcooling Charging Chart .....	19
Sensor or Switch Fault Codes .....	10	3-1/2 Ton Subcooling Charging Chart .....	19
Wiring Related Fault Codes .....	11	4 Ton Subcooling Charging Chart .....	19
Defrost Initiate Curves .....	13	5 Ton Subcooling Charging Chart .....	19

## SECTION I: GENERAL

The outdoor units are designed to be connected to a matching indoor coil with sweat connect lines. Sweat connect units are factory charged with refrigerant for a matching indoor coil plus 15 feet of field supplied lines.

Matching indoor coils are available with a thermal expansion valve or an orifice liquid feed sized for the most common usage. The orifice size and/or refrigerant charge may need to be changed for some indoor-outdoor unit combinations, elevation differences, or total line lengths. Refer to Application Data covering "General Piping Recommendations and Refrigerant Line Length" (Part Number 036-61920-001).

## SECTION II: SAFETY



This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

**DANGER** indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury**.

**WARNING** indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury**.

**CAUTION** indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury**. It is also used to alert against unsafe practices and hazards involving only property damage

### WARNING

*Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer, or service agency.*

### CAUTION

*This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.*

## INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's delivery receipt. A separate request for inspection by the carrier's agent should be made in writing. See Local Distributor for more information.

## LIMITATIONS

The unit should be installed in accordance with all National, State, and Local Safety Codes and the limitations listed below:

1. Limitations for the indoor unit, coil, and appropriate accessories must also be observed.
2. The outdoor unit must not be installed with any duct work in the air stream. The outdoor fan is the propeller type and is not designed to operate against any additional external static pressure.
3. The maximum and minimum conditions for operation must be observed to assure a system that will give maximum performance with minimum service.

AIR TEMPERATURE AT OUTDOOR COIL, °F				AIR TEMPERATURE AT INDOOR COIL, °F			
Min.		Max.		Min.		Max.	
DB Cool	DB Heat	DB Cool	DB Heat	WB Cool	DB Heat	WB Cool	DB Heat
50	-10	115	75	57	50 <sup>1</sup>	72	80

1. Operation below this temperature is permissible for a short period of time, during morning warm-up.
4. The maximum allowable line length for this product is 75 feet.

## SECTION III: UNIT INSTALLATION

### LOCATION

Before starting the installation, select and check the suitability of the location for both the indoor and outdoor unit. Observe all limitations and clearance requirements.

The outdoor unit must have sufficient clearance for air entrance to the condenser coil, for air discharge, and for service access. See Figure 1.

**NOTE:** For multiple unit installations, units must be spaced a minimum of 18 inches apart. (Coil face to coil face.)

If the unit is to be installed on a hot sun exposed roof or a black-topped ground area, the unit should be raised sufficiently above the roof or ground to avoid taking the accumulated layer of hot air into the outdoor unit.

Provide an adequate structural support.

### ADD-ON REPLACEMENT/RETROFIT

The following steps should be performed in order to insure proper system operation and performance.

1. Change-out of the indoor coil to an approved R-22 coil/condensing unit combination with the appropriate metering device.
2. If the outdoor unit is being replaced due to a compressor burnout, then installation of a 100% activated alumina suction-line filter drier is required, in addition to the factory installed liquid-line drier. Operate the system for 10 hours. Monitor the suction drier pressure drop. If the pressure drop exceeds 3 psig, replace both the suction-line and liquid-line driers. After a total of 10 hours run time where the suction-line pressure drop has not exceeded 3 psig, replace the liquid line drier, and remove the suction-line drier. Never leave a suction-line drier in the system longer than 50 hours of run time.

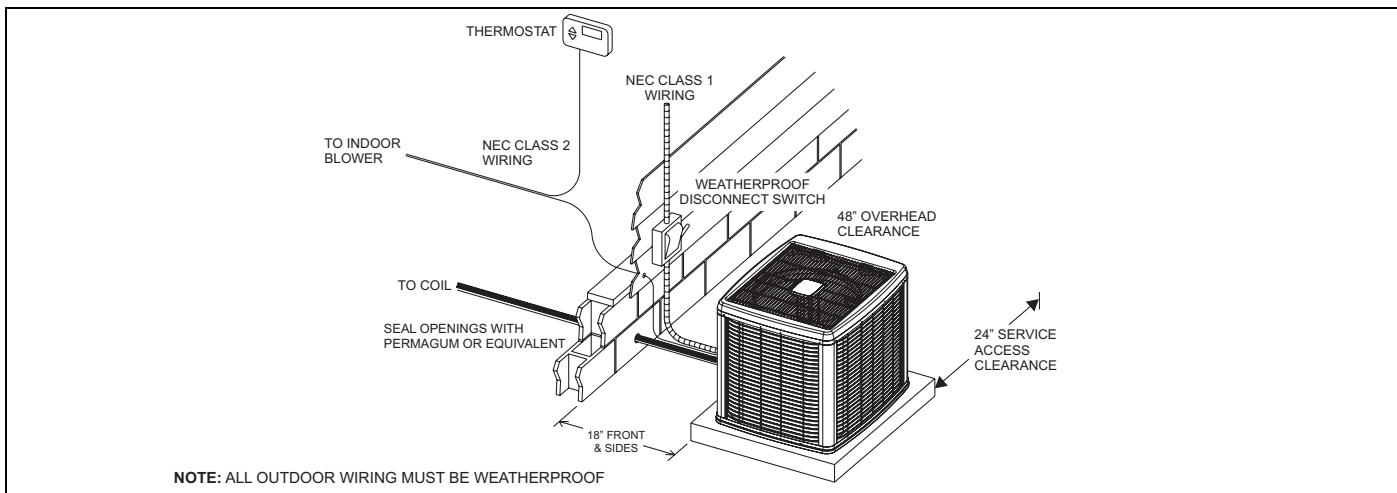


FIGURE 1: Typical Installation

## GROUND INSTALLATION

The unit may be installed at ground level on a solid base that will not shift or settle, causing strain on the refrigerant lines and possible leaks. Maintain the clearances shown in Figure 1 and install the unit in a level position.

Normal operating sound levels may be objectionable if the unit is placed directly under windows of certain rooms (bedrooms, study, etc.).

Condensate will drain from beneath the coil of the outdoor unit during the defrost cycle. Normally this condensate may be allowed to drain directly on the ground.

### WARNING

*The outdoor unit should not be installed in an area where mud or ice could cause personal injury. Remember that condensate will drip from the unit coil during heat and defrost cycles and that this condensate will freeze when the temperature of the outdoor air is below 32°F.*

Elevate the unit sufficiently to prevent any blockage of the air entrances by snow in areas where there will be snow accumulation. Check the local weather bureau for the expected snow accumulation in your area.

Isolate the unit from rain gutters to avoid any possible wash out of the foundation.

## ROOF INSTALLATION

When installing units on a roof, the structure must be capable of supporting the total weight of the unit, including a pad, lintels, rails, etc., which should be used to minimize the transmission of sound or vibration into the conditioned space.

## UNIT PLACEMENT

1. Provide a base in the pre-determined location.
2. Remove the shipping carton and inspect for possible damage.
3. Compressor tie-down bolts should remain tightened.
4. Position the unit on the base provided.

**NOTE:** Heat pumps will defrost periodically resulting in water drainage. The unit should not be located where water drainage may freeze and create a hazardous condition - such as sidewalks and steps.

## LIQUID LINE FILTER-DRIER

The heat pumps have a solid core bi-flow filter/drier located on the liquid line.

**NOTE:** Replacements for the liquid line drier must be exactly the same as marked on the original factory drier. See Source 1 for O.E.M. replacement driers.

### CAUTION

Failure to do so or using a substitute drier or a granular type may result in damage to the equipment.

Filter-Drier Source 1 Part No.	Apply with Models
	YMB / HC3A / HL3A
026 - 25512 - 000	All Sizes

## PIPING CONNECTIONS

The outdoor unit must be connected to the indoor coil using field supplied refrigerant grade copper tubing that is internally clean and dry. Units should be installed only with the tubing sizes for approved system combinations as specified in Tabular Data Sheet. The charge given is applicable for total tubing lengths up to 15 feet. See Application Data Part Number 036-61920-001 for installing tubing of longer lengths and elevation differences.

**NOTE:** Using a larger than specified line size could result in oil return problems. Using too small a line will result in loss of capacity and other problems caused by insufficient refrigerant flow. Slope horizontal vapor lines at least 1" every 20 feet toward the outdoor unit to facilitate proper oil return.

## OIL TRAPPING

When the outdoor unit is above the indoor coil oil trapping is necessary. An oil trap should be provided for every 20 ft. of rise. See Figure 2.

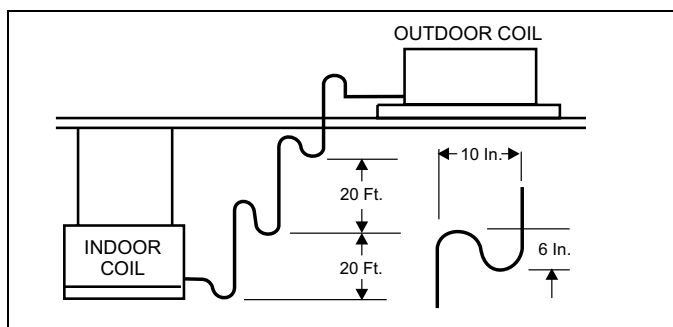


FIGURE 2: Oil Trap

## PRECAUTIONS DURING LINE INSTALLATION

1. Install the lines with as few bends as possible. Care must be taken not to damage the couplings or kink the tubing. Use clean hard drawn copper tubing where no appreciable amount of bending around obstruction is necessary. If soft copper must be used, care must be taken to avoid sharp bends which may cause a restriction.
2. The lines should be installed so that they will not obstruct service access to the coil, air handling system, or filter.
3. Care must also be taken to isolate the refrigerant lines to minimize noise transmission from the equipment to the structure.
4. The vapor line must be insulated with a minimum of 1/2" foam rubber insulation (Armaflex or equivalent). Liquid lines that will be exposed to direct sunlight and/or high temperatures must also be insulated.

Tape and suspend the refrigerant lines as shown. DO NOT allow tube metal-to-metal contact. See Figure 3.

5. Use PVC piping as a conduit for all underground installations as shown in Figure 4. Buried lines should be kept as short as possible to minimize the build up of liquid refrigerant in the vapor line during long periods of shutdown
6. Pack fiberglass insulation and a sealing material such as perma-gum around refrigerant lines where they penetrate a wall to reduce vibration and to retain some flexibility.
7. See Form 690.01-AD1V for additional piping information.

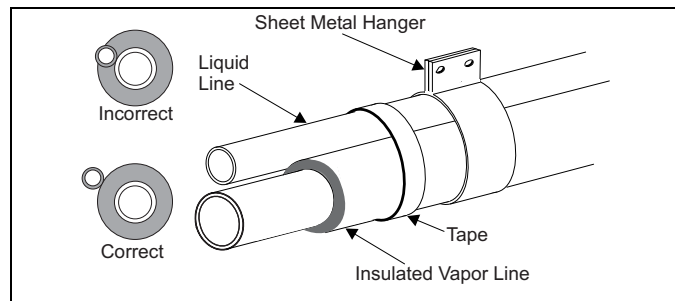


FIGURE 3: Tubing Hanger

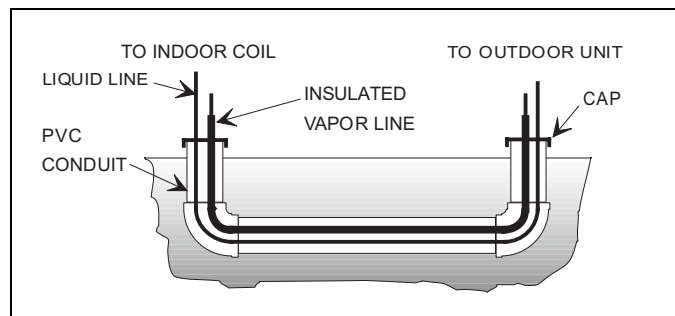


FIGURE 4: Underground Installation

## PRECAUTIONS DURING BRAZING OF LINES

All outdoor unit and evaporator coil connections are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5 or equivalent. DO NOT use soft solder. The outdoor units have reusable service valves on both the liquid and vapor connections. The total system refrigerant charge is retained within the outdoor unit during shipping and installation. The reusable service valves are provided to evacuate and charge per this instruction.

Serious service problems can be avoided by taking adequate precautions to assure an internally clean and dry system.

### CAUTION

*Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.*

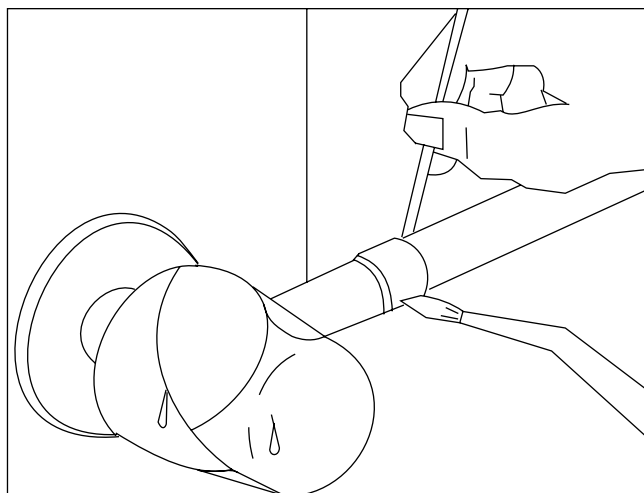


FIGURE 5: Heat Protection

## PRECAUTIONS DURING BRAZING SERVICE VALVE

Precautions should be taken to prevent heat damage to service valve by wrapping a wet rag around it as shown in Figure 5. Also, protect all painted surfaces, insulation, and plastic base during brazing. After brazing cool joint with wet rag.

### WARNING

*This is not a backseating valve. The service access port has a valve core. Opening or closing valve does not close service access port.*

*If the valve stem is backed out past the chamfered retaining wall, the O-ring can be damaged causing leakage or system pressure could force the valve stem out of the valve body possibly causing personal injury.*

Valve can be opened by removing the plunger cap and fully inserting a hex wrench into the stem and backing out counter-clockwise until valve stem just touches the chamfered retaining wall.

### Connect the refrigerant lines using the following procedure:

1. Remove the cap and Schrader core from both the liquid and vapor service valve service ports at the outdoor unit. Connect low pressure nitrogen to the liquid line service port.
2. Braze the liquid line to the liquid valve at the outdoor unit. Be sure to wrap the valve body with a wet rag. Allow the nitrogen to continue flowing. Refer to the Tabular Data Sheet for proper liquid line sizing.
3. Carefully remove the rubber plugs from the evaporator liquid and vapor connections at the indoor coil.

### CAUTION

*The evaporator is pressurized.*

4. Braze the liquid line to the evaporator liquid connection. Nitrogen should be flowing through the evaporator coil.
5. Slide the grommet away from the vapor connection at the indoor coil. Braze the vapor line to the evaporator vapor connection. After the connection has cooled, slide the grommet back into original position. Refer to the Tabular Data Sheet for proper vapor line sizing.
6. Protect the vapor valve with a wet rag and braze the vapor line connection to the outdoor unit. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
7. Replace the Schrader core in the liquid and vapor valves.
8. Go to "SECTION IV" for TXV installation.
9. Leak test all refrigerant piping connections including the service port flare caps to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).
10. Evacuate the vapor line, evaporator, and the liquid line to 500 microns or less.

**NOTE:** Line set and indoor coil can be pressurized to 250 psig with dry nitrogen and leak tested with a bubble type leak detector. Then release the nitrogen charge.

**NOTE:** Do not use the system refrigerant in the outdoor unit to purge or leak test.

11. Replace cap on service ports. Do not remove the flare caps from the service ports except when necessary for servicing the system.

### CAUTION

*Do not connect manifold gauges unless trouble is suspected. Approximately 3/4 ounce of refrigerant will be lost each time a standard manifold gauge is connected.*

12. Release the refrigerant charge into the system. Open both the liquid and vapor valves by removing the plunger cap and with an allen wrench back out counter-clockwise until valve stem just touches the chamfered retaining wall. See Page 4 "PRECAUTIONS DURING BRAZING SERVICE VALVE".
13. Replace plunger cap finger tight, then tighten an additional 1/12 turn (1/2 hex flat). Cap must be replaced to prevent leaks.

### WARNING

*Never attempt to repair any brazed connections while the system is under pressure. Personal injury could result.*

See "System Charge" section for checking and recording system charge.

## SECTION IV: INSTALLATIONS REQUIRING TXV

For installations requiring a TXV, the following are the basic steps for installation. For detailed instructions, refer to the Installation Instructions accompanying the TXV kit.

Install TXV kit as follows:

1. First, relieve the holding charge by depressing the Schrader valve located in the end of the liquid line.
2. After holding charge is completely discharged, loosen and remove the liquid line fitting from the orifice distributor assembly. Note that the fitting has **right hand threads**.
3. Remove the orifice from the distributor body using a small diameter wire or paper clip. Orifice is not used when the TXV assembly is installed.
4. After orifice is removed, install the thermal expansion valve to the orifice distributor assembly with supplied fittings. Hand tighten and turn an additional 1/8 turn to seal. **Do not overtighten fittings.**
5. Reinstall the liquid line to the top of the thermal expansion valve. Hand modify the liquid line to align with casing opening.
6. Install the TXV equalizer line into the vapor line as follows:
  - a. Select a location on the vapor line for insertion of the equalizer line which will not interfere with TXV bulb placement.
  - b. Use an awl to punch through the suction tube and insert the awl to a depth to achieve a 1/8" diameter hole.
7. Install TXV equalizer line in 1/8" hole previously made in vapor line. Equalizer line should not be bottomed out in vapor line. Insert equalizer line at least 1/4" in the vapor line. Braze equalizer line making sure that tube opening is not brazed closed.

### CAUTION

*Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.*

All connections to be brazed are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5 or equivalent. DO NOT use soft solder.

Install the TXV bulb to the vapor line near the equalizer line, using the two bulb clamps furnished with the TXV assembly. Ensure the bulb is making maximum contact. Refer to TXV installation instruction for view of bulb location.

### CAUTION

*In all cases, mount the TXV bulb after vapor line is brazed and has had sufficient time to cool.*

- a. Bulb should be installed on a horizontal run of the vapor line if possible. On lines under 7/8" OD the bulb may be installed on top of the line. With 7/8" OD and over, the bulb should be installed at the position of about 2 or 10 o'clock.
- b. If bulb installation is made on a vertical run, the bulb should be located at least 16 inches from any bend, and on the tubing sides opposite the plane of the bend. The bulb should be positioned with the bulb tail at the top, so that the bulb acts as a reservoir.
- c. Bulb should be insulated using thermal insulation provided to protect it from the effect of the surrounding ambient temperature.

## SECTION V: ELECTRICAL CONNECTIONS

### GENERAL INFORMATION & GROUNDING

Check the electrical supply to be sure that it meets the values specified on the unit nameplate and wiring label.

Power wiring, control (low voltage) wiring, disconnect switches, and over current protection must be supplied by the installer. Wire size should be sized per NEC requirements.

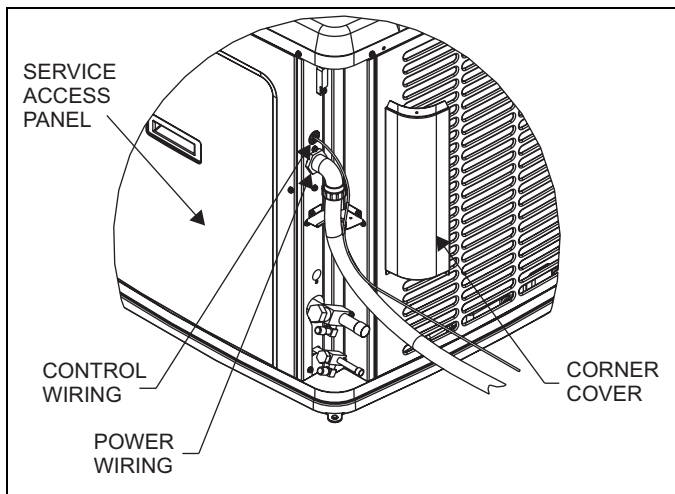
### CAUTION

*All field wiring must **USE COPPER CONDUCTORS ONLY** and be in accordance with Local, National Fire, Safety & Electrical Codes. This unit must be grounded with a separate ground wire in accordance with the above codes.*

The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel and in Figure 14 of this instruction.

## FIELD CONNECTIONS POWER WIRING

1. Install the proper size weatherproof disconnect switch outdoors and within sight of the unit.
2. Remove the screws at the bottom of the corner cover. Slide corner cover down and remove from unit. See Figure 6.
3. Run power wiring from the disconnect switch to the unit.
4. Remove the service access panel to gain access to the unit wiring. Route wires from disconnect through power wiring opening provided and into the unit control box as shown in Figure 6.
5. Install the proper size time-delay fuses or circuit breaker, and make the power supply connections.
6. Energize the crankcase heater if equipped to save time by pre-heating the compressor oil while the remaining installation is completed.



**FIGURE 6:** Typical Field Wiring

## FIELD CONNECTIONS CONTROL WIRING

1. Route low voltage wiring into bottom of control box as shown in Figure 5.

2. Replace the corner cover and service access panel that were removed in Steps 2 and 4 of the "Field Connections Power Wiring" section.
3. All field wiring to be in accordance with national electrical codes (NEC) and/or local-city codes.

**NOTE:** A Start Assist Kit is available and recommended for long line set applications or in areas of known low voltage problems.

4. Mount the thermostat about 5 ft. above the floor, where it will be exposed to normal room air circulation. Do not place it on an outside wall or where it is exposed to the radiant effect from exposed glass or appliances, drafts from outside doors or supply air grilles.
5. Route the 24-volt control wiring (NEC Class 2) from the outdoor unit to the indoor unit and thermostat.

**NOTE:** To eliminate erratic operation, seal the hole in the wall at the thermostat with permagum or equivalent to prevent air drafts affecting the operation of in the thermostat.

## DEHUMIDIFICATION CONTROL

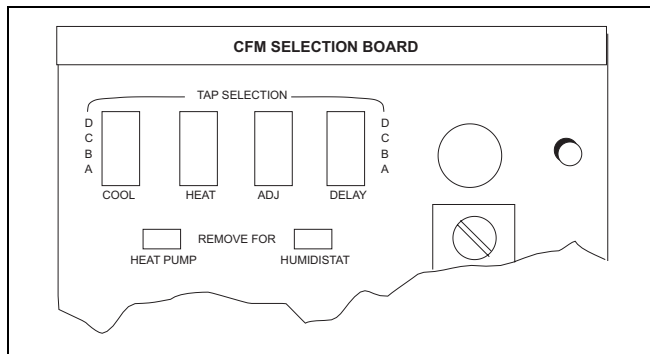
A dehumidification control accessory 2HU06700124 may be used with variable speed air handlers or furnaces in high humidity areas. This control works with the variable speed indoor unit to provide cooling at a reduced air flow, lowering evaporator temperature and increasing latent capacity. The humidistat in this control opens the humidistat contacts on humidity rise. Prior to the installation of the dehumidification control, the jumper across the HUMIDISTAT terminals on the indoor variable speed air handler or furnace CFM selection board must be removed.

During cooling, if the relative humidity in the space is higher than the desired set point of the dehumidification control, the variable speed blower motor will operate at lower speed until the dehumidification control is satisfied. A 40-60% relative humidity level is recommended to achieve optimum comfort.

If a dehumidification control is installed, it is recommended that a minimum air flow of 325 cfm/ton be supplied at all times.

For additional connection diagrams for all UPG equipment refer to "Low Voltage System Wiring" document available online at [www.upgnet.com](http://www.upgnet.com) in the Product Catalog Section.

## CFM SELECTION BOARD SETTINGS



**FIGURE 7:** CFM Selection Board

For proper system operation the CFM Selection Board jumpers must be set properly.

Refer to the Tabular Data Sheet for the recommended air flow settings for each size condensing unit.

Set the cooling speed per the instructions for the air handler or furnace by selecting the correct COOL and ADJ taps. Verify the airflow using the LED display on the CFM selection board.

The HEAT PUMP jumper **MUST** be removed for proper system operation.

The HUMIDISTAT jumper must also be removed if a dehumidistat is installed.

## SECTION VI: EVACUATION

It will be necessary to evacuate the system to 500 microns or less. If a leak is suspected, leak test with dry nitrogen to locate the leak. Repair the leak and test again.

To verify that the system has no leaks, simply close the valve to the vacuum pump suction to isolate the pump and hold the system under vacuum. Watch the micron gauge for a few minutes. If the micron gauge indicates a steady and continuous rise, it's an indication of a leak. If the gauge shows a rise, then levels off after a few minutes and remains fairly constant, it's an indication that the system is leak free but still contains moisture and may require further evacuation if the reading is above 500 microns.

## SECTION VII: SYSTEM CHARGE

The factory charge in the outdoor unit includes enough charge for the unit, a 15 ft. line set and the smallest indoor coil match-up. Some indoor coil matches may require additional charge. See tabular data sheet provided in unit literature packet for charge requirements.

### CAUTION

*Do not leave the system open to the atmosphere.*

The "TOTAL SYSTEM CHARGE" must be permanently stamped on the unit data plate.

Total system charge is determined as follows:

1. Determine outdoor unit charge from tabular data sheet.
2. Determine indoor coil adjustment from tabular data sheet.
3. Calculate the line charge using the tabular data sheet if line length is greater than 15 feet.
4. Total system charge = item 1 + item 2 + item 3.
5. Permanently stamp the unit data plate with the total amount of refrigerant in the system.

### CAUTION

*Refrigerant charging should only be carried out by a qualified air conditioning contractor.*

### CAUTION

*Compressor damage will occur if system is improperly charged. On new system installations, charge system per tabular data sheet for the matched coil and follow guidelines in this instruction.*

If a calibrated charging cylinder or accurate weighing device is available, add refrigerant accordingly. Otherwise, model-specific charging charts are provided in Tables 12 - 18 for cooling mode only. There is no accurate method for charging these units in the heating mode. If charging is required during the heating mode, the unit must be evacuated and charge weighed in according to the rating plate. If TXV indoor coils are used with the 2 through 3-1/2 ton models, the following subcooling charging method must be used. Superheat charging charts are not valid with TXV equipped systems.

### Subcooling Charging Method - Cooling Only

The recommended subcooling is 10°F

1. Set the system running in the cooling mode by setting the thermostat at least 6°F below the room temperature.
2. Operate the system for a minimum of 15-20 minutes.
3. Refer to the tabular data sheet for the recommended airflow and verify this indoor airflow (it should be about 400 SCFM per ton).
4. Measure the liquid refrigerant pressure P and temperature T at the service valve.
5. Calculate the saturated liquid temperature ST from Table 1.
6. Subcooling temperature TC = Saturated Temperature (ST) - Liquid Temp (T).

Example: The pressure P and temperature T measured at the liquid service port is 196 psig and 90°F, respectively. From Table 1, the saturated temperature for 196 psig is 100°F. The subcooling temperature TC = 100°-90°=10°F

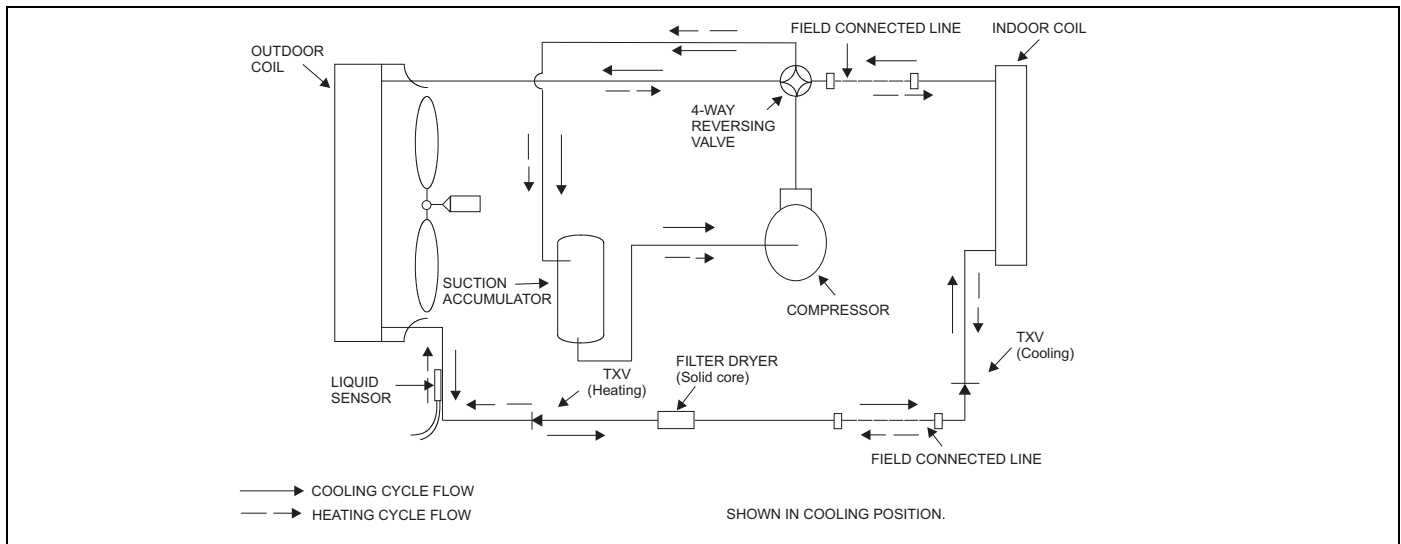
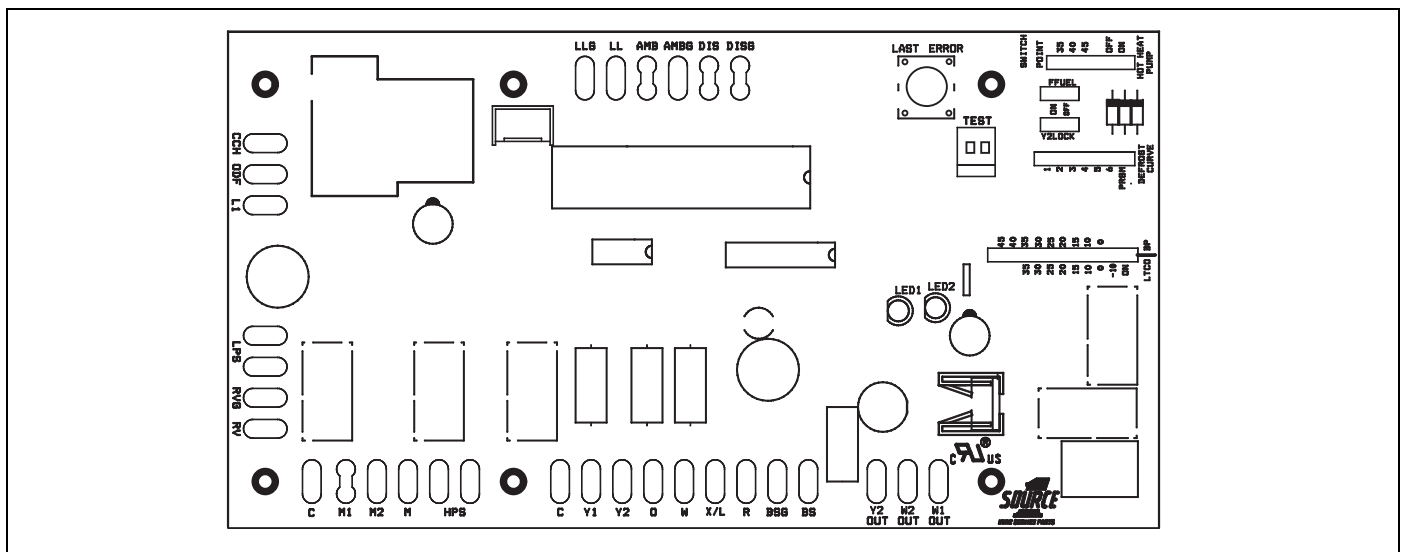
Add charge if the calculated subcooling temperature TC in Step 6 is lower than the recommended level. Remove and recover the refrigerant if the subcooling TC is higher than the recommended level. See Table 1 for R-22 saturation temperatures

See Figure 9 to trace the flow of refrigerant through the system.

Check flare caps on service ports to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).

**TABLE 1:** R-22 Saturated Properties

Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F
80	48	110	64	140	78	170	91	200	101	230	111
82	49	112	65	142	79	172	91	202	102	232	112
84	50	114	66	144	80	174	92	204	103	234	112
86	51	116	67	146	81	176	93	206	103	236	113
88	52	118	68	148	82	178	94	208	104	238	114
90	54	120	69	150	83	180	94	210	105	240	114
92	55	122	70	152	84	182	95	212	105	242	115
94	56	124	71	154	84	184	96	214	106	244	115
96	57	126	72	156	85	186	97	216	107	246	116
98	58	128	73	158	86	188	97	218	107	248	117
100	59	130	74	160	87	190	98	220	108	250	117
102	60	132	75	162	88	192	99	222	109	252	118
104	61	134	76	164	88	194	99	224	109	254	118
106	62	136	77	166	89	196	100	226	110	256	119
108	63	138	78	168	90	198	101	228	111	258	119

**FIGURE 8:** Heat Pump Flow Diagram**FIGURE 9:** Demand Defrost Control Module

## SECTION VIII: SYSTEM OPERATION

### REQUIRED CONTROL SETUP

**IMPORTANT:** The following steps must be taken at the time of installation to insure proper system operation.

1. Consult system wiring diagram to determine proper wiring for proper system configuration.
2. If hot heat pump configuration is desired, change HOT HEAT PUMP jumper to ON position.
3. If installation includes a fossil fuel furnace, change FFUEL jumper to ON position.
4. Set low temperature cutout (LTCO) and balance point (BP) jumpers as desired.
5. Verify proper system functionality. Confirm room thermostat operation including fault code display capability.
6. Upon completion of installation, verify that no fault codes are stored in memory. Clear the fault code memory if necessary.

### ANTI-SHORT CYCLE DELAY

The control includes a five-minute anti-short cycle delay (ASCD) timer to prevent the compressor from short cycling after a power or thermostat signal interruption. The ASCD timer is applied when the control is first powered from the indoor unit thermostat and immediately following the completion of a compressor run cycle. The compressor and the outdoor fan will not operate during the five minutes that the timer is active.

The ASCD timer can be bypassed by connecting the TEST terminals for three seconds while the thermostat is calling for compressor operation (Y1 input signal energized).

**TABLE 2:** TEST Input Functionality

Duration of connection (seconds)	Control behavior with no thermostat signals present	Control behavior with thermostat signals present
Less than 2	No response	No response
2-6	Display operational mode	Bypass ASCD. If Y1 is present and high-pressure switch is closed, contactors will be energized.
	Clear soft lockout	Clear soft lockout
	Clear hard lockout	Clear hard lockout
More than 6	Display operational mode Energize X/L with active defrost curve flash code	Initiate defrost cycle ignoring the liquid line and outdoor ambient temp. Energize X/L with active defrost curve flash code
Connection removed	Resume normal LED display	Terminate defrost as normal or until O signal is energized.
Connection not removed	Display operational mode Energize X/L with active defrost curve flash code	Continue defrost cycle and X/L flash code until TEST connection removed.

### LED DIAGNOSTIC INDICATORS

The control includes two LED's that display various types of diagnostic information. LED1 is red and LED2 is green. The location of the LED's is shown in Figures 10 and 13. These LED's are used to display operational mode, status, and fault information.

### OPERATIONAL MODE DETECTION

The control can be used in a variety of applications including heat pumps and air conditioners with modulating compressors. The control uses various inputs to determine the proper mode of operation.

It looks for the presence of a reversing valve connected to the RV and RVG terminals to determine if it should operate as a heat pump or an air conditioner. If the reversing valve is not connected, the control will not operate in the heat pump mode. The control senses the reversing valve loads and determines the operational mode each time power to the control is cycled.

The control also senses the connections that are made to the M, M1, and M2 terminals and determines the correct operational mode for the control. This is done each time power to the control is cycled. Therefore, it is important that no loads be attached to the M1 or M2 terminals of the control. Incorrect system behavior could result.

### LOW VOLTAGE DETECTION

The control monitors the transformer secondary (24 VAC) voltage and provides low voltage protection for the heat pump and its components. In particular, the control prevents contactor chatter during low voltage conditions. If the voltage drops below approximately 19 VAC, the control will continue to energize any relays that are already energized but will not energize any additional relays until the voltage level increases. If the voltage drops below approximately 16 VAC, the control will immediately de-energize the relay outputs and will not energize any relays until the voltage level increases. The control will store and display the appropriate fault codes when low voltage conditions occur.

### CRANKCASE HEATER

The control energizes the crankcase heater terminal (CCH) whenever line voltage is applied to the control and the outdoor fan is not on. If the compressor is equipped with a crankcase heater, it will be energized from the CCH terminal of the control.

### TEST INPUT

The control includes a TEST input connector that can be used for various testing functions during installation and service. The TEST input connector is shown in Figures 10 and 13. The following table summarizes the behavior of the control when the two TEST pins are connected. More detailed descriptions of the various functions are included in other sections of this document.

**IMPORTANT:** Do not connect any loads to the M1 or M2 terminals of the control. Incorrect system behavior could result.

### OPERATIONAL MODE DISPLAY

The control will display its active operational mode using the onboard LED's when the TEST pins are connected while no thermostat signals are energized. See Table 3. The control will display the operational mode as long as the TEST pins are shorted and no thermostat signals are energized. When the TEST pin short is removed, the control will return to normal LED displays. The X/L output will be energized (with the number of flashes corresponding to the active defrost curve) while the operational mode is displayed. For example, if defrost curve 2 is active, the X/L output will be energized with two flashes while the operational mode is being displayed on the LED's.

**TABLE 3:** Operational Mode Display

Operational Mode	LED1 (Red)	LED2 (Green)
Heat Pump		ON
Air Conditioner		OFF
Single-Stage Compressor	1	
Reciprocating Two-Stage Compressor	2	
Scroll Two-Stage Compressor	3	---

If the control displays an operational mode other than LED2 (Green) ON and LED1 (Red) 1 flash indicating a heat pump with a single stage compressor, an error condition exists. Check all wiring of the reversing valve (RV and RVG terminals) and compressor outputs (M, M1, and M2 terminals). Cycle 24 VAC power to the control and check the operational mode again.

## STATUS MODE DISPLAY

The control also provides status codes using the LED's. Status codes indicate the state of operation of the unit but do not represent a fault. Table 4 describes the LED displays during status codes. Status codes will not be displayed when a fault code is present.

During the following conditions, the control will not energize the X/L output.

**TABLE 4:** Status Code Display

Description	LED1 (Red)	LED2 (Green)
No power to control	OFF	OFF
First-stage compressor operation – not applicable to single stage compressor	OFF	ON
Second-stage or full capacity compressor operation	ON	ON
Control normal operation – no call for compressor	OFF	2 sec ON 2 sec OFF
Control normal operation – call for compressor and ASCD timer (5 min.) is active	OFF	Rapid Flash
No fault codes in memory – Initiated by LAST ERROR pushbutton	2	2
Fault code memory cleared – Initiated by LAST ERROR pushbutton	3	3

## FAULT CODE DISPLAY

### X/L Output

The X/L terminal of the heat pump control is typically connected to the X/L input of the room thermostat. The thermostat uses this signal to notify the homeowner of a problem with the heat pump using an LED or LCD display. When the control energizes the X/L terminal, the thermostat displays the flash code so the homeowner can see it.

The heat pump control informs the homeowner of the type of condition that is present using flash codes. Table 5 shows the condition categories and the corresponding X/L flash codes.

The control will continue to energize the X/L output for fault codes having an X/L code of 4 flashes even after the thermostat calls are removed. The control does this to notify the installer or homeowner that a significant problem with the wiring or system configuration is present and needs to be corrected.

The control will continue to energize the X/L output until the condition that caused the fault condition no longer exists.

**TABLE 5:** X/L Output Categories

Condition Category	X/L
Soft Lockout – Reset with interruption of thermostat call following correction of fault condition	2 flashes
Hard Lockout – Reset by cycling power to system	3 flashes
Wiring, sensor or control setting related error	4 flashes

## LED Display

The control will display any fault code that is currently active using the LED's. The control will display the fault code, pause two seconds, and display the fault again. The control will continue the fault code display until the condition that caused the fault code no longer exists. If multiple fault codes are present at the same time, the control will display only the most recent fault. The other active errors may be accessed from memory using the LAST ERROR pushbutton.

### Operational Fault Codes

Table 6 shows the operational faults that the control can detect. The control displays this type of error by flashing LED1 (Red) only. LED1 (Green) is not energized. These faults typically occur when the heat pump has been operating and a problem occurs.

**TABLE 6:** Operational Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
<b>Operational Faults</b>			
Control Failure that still allows fault code output	ON	OFF	4 if possible
High-pressure switch fault (not in lockout yet)	1	OFF	OFF
High-pressure switch lockout (last mode of operation was heat pump)	2	OFF	2 (soft) 3 (hard)
High-pressure switch lockout (last mode of operation was defrost)	3	OFF	2 (soft) 3 (hard)
Low-pressure switch lockout	4	OFF	2 (soft) 3 (hard)
Low Voltage (< 19 VAC) preventing further relay outputs	5	OFF	OFF
Low Voltage (< 16 VAC) stopped current relay outputs	6	OFF	OFF
Pipe Freeze Protection Timer expiration	7	OFF	4

### Sensor or Switch Fault Codes

Table 7 shows the faults that the control can detect when a problem is present with a sensor or switch. The control displays this type of error by energizing LED1 (Red) constantly and flashing LED2 (Green). These faults typically occur when the heat pump has been operating and a problem occurs with a sensor or its wiring. These faults could also occur during installation as the heat pump is configured.

**TABLE 7:** Sensor or Switch Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
<b>Required Sensor or Switch Faults</b>			
Outdoor ambient sensor failure (short)	ON	1	2 (soft)
Outdoor ambient sensor failure (open)	ON	2	2 (soft)
Liquid line sensor failure (short)	ON	3	2 (soft)
Liquid line sensor failure (open)	ON	4	2 (soft)
<b>Optional Discharge Line Sensor Faults</b>			
High discharge line temperature	ON	5	2 (soft) 3 (hard)
Low discharge line temperature	ON	6	2 (soft) 3 (hard)
Discharge line sensor failure (short)	ON	7	2 (soft)
<b>Optional Bonnet Sensor Faults</b>			
Bonnet sensor failure (short)	ON	8	4
Fossil Fuel Mode setting error (FFUEL jumper in OFF position but bonnet sensor present)	ON	9	4

## Wiring Related Fault Codes

Table 8 shows the faults that the control can detect when a problem is present with the system wiring or jumper configurations. The control displays this type of error by flashing LED1 (Red) and energizing LED2 (Green) constantly. These faults typically occur when the heat pump is first installed or when a system component such as the room thermostat or indoor unit is replaced or rewired.

**TABLE 8:** Wiring Related Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
<b>Wiring Related Faults</b>			
Compressor Contactor Miswire	1	ON	4
Y2 present without Y1	2	ON	4
Y1 and W present without Y2 in two stage mode	3	ON	4
O signal received in AC mode	4	ON	4
W signal received in AC mode	5	ON	4
W and O signal received in AC mode	6	ON	4
W and O signal received in HP mode	7	ON	4
Defrost Curve Jumper Error (Invalid jumper setting preventing compressor operation)	8	ON	4

## FAULT CODE MEMORY

### Displaying Stored Fault Codes

The control will store up to five fault codes in memory. If more than five faults occur, the five most recent fault codes will remain in memory. The stored faults can be displayed by depressing the LAST ERROR pushbutton for one to five seconds while no thermostat inputs to the control are energized. See Figures 10 and 13 for the location of the pushbutton. Since some room thermostats energize the O signal even when not calling for compressor operation, turn the room thermostat to the SYSTEM OFF setting when displaying fault codes.

When the LAST ERROR pushbutton is depressed and released, the control will display the stored fault codes beginning with the most recent. The control will display the most recent fault code, pause two seconds, and display the next fault code. The control will display the stored error codes and then return to the normal LED status display mode. The stored fault codes can be displayed again by depressing the pushbutton again. When the control displays the fault codes with the onboard LED's, it will also energize the X/L output with the corresponding flash code. The X/L output signal can be observed at the room thermostat or at the control using a 24VAC LED test device connected to the X/L terminal.

If the control has no fault codes stored in memory, it will flash both LED's twice simultaneously. If a thermostat signal is energized while the control is displaying the stored error codes, the control will stop displaying the stored error codes and resume normal operation.

### Clearing Fault Code Memory

Once the stored fault codes have been displayed and recorded, the installer should clear the stored fault codes from the control's memory. This practice will enable better troubleshooting and diagnosis of system problems. If the stored fault codes are not cleared after the cause of the problem has been resolved, a service technician doing a later service call may not know that the fault codes in the memory were caused by a problem that has already been fixed. The technician may waste time trying to fix a condition that no longer exists. Therefore, it is very important to always clear the fault code memory after the unit is installed and running properly following a service call.

**IMPORTANT:** Always clear the fault code memory after resolving the condition that caused the fault code.

To clear the fault code memory, depress the LAST ERROR pushbutton for longer than 5 seconds. The control will flash both LED's three times to indicate that the memory has been cleared. To confirm that the memory has been cleared, depress the LAST ERROR pushbutton for one to five seconds. The control will flash both LED's twice to indicate that no faults are stored in memory.

## LOCKOUT MODES

### Soft Lockout

The control will cause a soft lockout during the following conditions. Detailed descriptions of the conditions required for the control to enter the soft lockout mode are contained in other sections of this document.

- High-pressure switch
  - Two openings within six hours
- Low-pressure switch
  - One opening of the switch for more than five seconds except under certain conditions.
- High discharge temperature (with optional discharge sensor)
  - Temperature reading exceeds 263F
- Low discharge temperature (with optional discharge sensor)
  - Temperature reading does not reach 90F following timer expiration under certain conditions.

During the soft lockout mode, the control will do the following.

- De-energize the compressor
- If in heating mode, the control will energize auxiliary heat as if the outdoor ambient temperature was below the LTCO setting.
- Energize the LED and X/L outputs with the appropriate flash codes
- Store the appropriate fault code in memory.

The control will reset the soft lockout condition when any of the following occur following removal of the fault condition.

- Power is cycled to the R or Y1 inputs of the control. This will cause the soft lockout condition to be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode.
- The TEST terminals are shorted for more than two seconds.

When the soft lockout condition is reset, the control will stop displaying the fault code and will respond to thermostat inputs normally.

### Hard Lockout

If four soft lockouts occur within a twelve-hour period, the control shall cause a hard lockout condition. These soft lockouts can be caused by the same or different conditions. The control will function in the same way during soft and hard lockout conditions. The difference is in the requirements for resetting the lockout condition. The control will reset the hard lockout condition when any of the following occur following removal of the fault condition.

- Power is removed from the R input of the control.
- The TEST terminals are shorted for more than two seconds.

A hard lockout condition will not be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode. Power (24 VAC) to the control must be removed and reapplied.

When the hard lockout condition is reset, the control will de-energize the LED and X/L outputs and respond to thermostat inputs normally.

### Wiring or Setting Related Lockouts

The control will not operate the compressor when the following faults occur. These faults can be reset using the same methods used to reset a soft lockout. However, two occurrences of these faults will not cause a hard lockout condition.

- Presence of Y2 thermostat signal without Y1.
- Shorted discharge sensor input
- Shorted bonnet sensor
- Shorted or open liquid line or outdoor ambient sensor
- Defrost curve jumper error

If a compressor wiring error is detected, the control will not operate the compressor. Once the compressor wiring error has been detected, power (24 VAC) must be cycled to the control for the control to sense the wiring change and clear the lockout condition.

## DEFROST OPERATION

### General

The control maintains proper airflow through the outdoor coil during heating operation by melting frost and ice that may form on the coil. Frost may accumulate unevenly in different sections of the coil because of the arrangement of the refrigeration circuit within the coil. The control may initiate a defrost cycle even when the coil is not completely covered with frost. This is normal operation.

The control regulates the defrost operation of the heat pump based on accumulated compressor run time, outdoor coil temperature, and outdoor ambient temperature. The control will cause the unit to operate in the normal heating mode until it determines that a defrost cycle is needed.

All defrost timings are based on accumulated compressor run time.

### Operation

The defrost mode is equivalent to the cooling mode except that the outdoor fan motor is de-energized. The control shall do the following to initiate a defrost cycle.

- De-energize the outdoor fan
- Energize the crankcase heater
- Energize the reversing valve
- Energize the auxiliary heat outputs based on the system configuration
- Energize Y2Out terminal if not already energized
- Begin the maximum defrost cycle length timer

If the call for heating (Y1) is removed from the control during the defrost cycle, it will terminate the defrost cycle and de-energize the compressor. The control will also stop the defrost cycle length timer but not reset it. When the control receives another call for heating, it will restart the defrost cycle and the timer at the point at which the call for heating was removed. This will happen only if the liquid line temperature conditions allow defrost to occur.

### Defrost Curves

The control uses a set of defrost curve parameters that are selected using the defrost curve selection jumper. The location of the defrost curve selection jumper is shown in Figures 10 and 13. Table 9 shows the jumper position that is appropriate for each heat pump model. Jumper positions 5, and 6 are not used and the control will not allow the compressor to operate when the jumper is in any of these positions.

### Defrost Curve Selection

The factory activates the correct defrost curve during production. They will place the defrost curve selection jumper in the PRGM position or in a numbered position appropriate for the specific heat pump model. You should not have to change the defrost curve selection jumper during initial installation.

If the jumper is inadvertently moved, it should be placed in the appropriate numbered location based on the model number and Table 9. If the factory has activated the curve using the PRGM position, the jumper may also be returned to that position. If, however, the factory has not activated the curve in the PRGM position and the jumper is placed in the PRGM position, the control will not energize the compressor. The control will also not energize the compressor if the defrost curve selection jumper is in a numbered position that is not described in Table 9 or if the defrost curve selection jumper is missing. The control will display the proper fault code when a defrost curve jumper error is present. If the jumper is missing, the control will behave as if the jumper was in the PRGM position. If the jumper is placed in a numbered position, the defrost curve selected by the jumper will override the defrost curve activated at the factory until the jumper is returned to the PRGM position. The control will display the active defrost curve using the X/L terminal when the heat pump is operating in a defrost cycle that has been forced using the TEST inputs. It will also display the active defrost curve using the X/L terminal when the operational mode is being displayed using the LED's. For instance, the X/L output will be energized with two flashes when defrost curve 2 is active. The control will lock out the compressor if the defrost curve selection jumper is not properly set.

### Defrost Cycle Initiation

The control will allow the heat pump to operate in the heating mode until the combination of outdoor ambient and outdoor coil temperatures indicate that a defrost cycle is necessary.

The control will initiate a defrost cycle when the liquid line temperature is below the initiate point for the measured ambient temperature (See Figure 11) continuously for 4-1/2 minutes. This delay eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

The control will initiate a defrost cycle every 6 hours (accumulated compressor run time) to recirculate refrigerant lubricants. This forced defrost timer will be reset and restarted following the completion or termination of a defrost cycle.

The control will also initiate a defrost cycle when the TEST terminals are shorted. This feature allows an installer or service technician to start a defrost cycle immediately as required. When the TEST terminals are shorted for more than six seconds with a Y1 input energized and the high-pressure switch closed, the ASCD will be bypassed and the compressor will be energized. If an O signal is present, the control will not initiate a defrost cycle. If the defrost cycle is initiated using the TEST terminals, the control will bypass the normal auxiliary heat timings and will energize the W1 Out and W2 Out terminals immediately when it begins the defrost cycle.

When the TEST inputs are used to force a defrost cycle, the control will ignore the state of the liquid line temperature and outdoor ambient temperature inputs. The coil does not have to be cold and the outdoor temperature does not have to be within a certain range for the heat pump to be forced into a defrost cycle. After the TEST input jumper is removed, the defrost mode will be terminated as normal. The defrost cycle length timer will not be started until the TEST input is removed. If the TEST terminals remain shorted, the control will keep the unit in defrost mode.

### Defrost Inhibition

The control will not initiate a defrost cycle if the liquid line temperature is above 40F unless the defrost cycle is forced using the TEST input.

The control will not initiate a defrost cycle when the outdoor ambient temperature is below -25F or above 55F unless the defrost cycle is forced using the TEST input.

The control will also prevent a defrost cycle from being initiated too soon after the initiation of the previous defrost cycle. When power is applied to the control and after the completion or termination of each defrost cycle, the control will start a 40-minute timer. When this timer expires, the control will allow another defrost cycle when needed. The timer is based on accumulated compressor run time.

### Defrost Termination

The control will terminate the defrost cycle immediately after the liquid line temperature reaches 80F or after eight minutes of defrost operation.

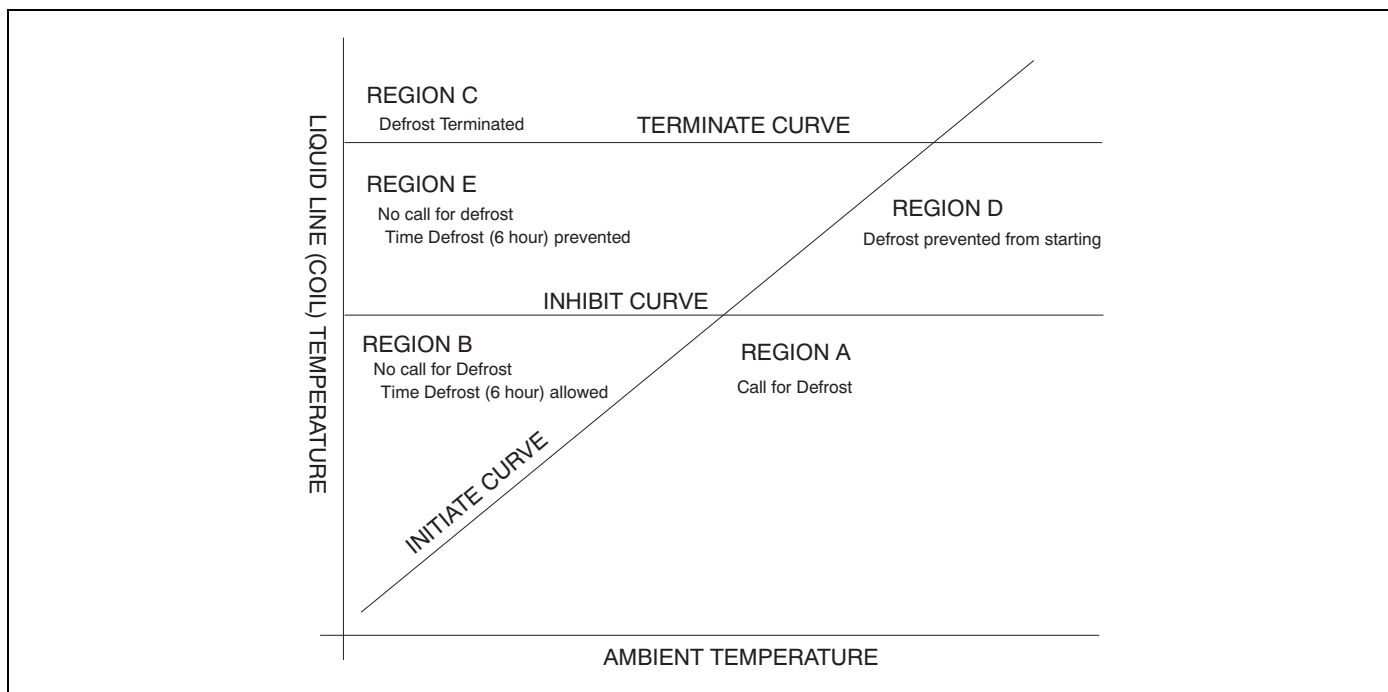
The control will also terminate a defrost cycle that has been forced using the TEST input when the O input is energized. The control will not terminate a normal defrost cycle when it receives an O input.

The control will do the following to terminate a defrost cycle.

- Energize the outdoor fan
- De-energize the crankcase heater
- De-energize the reversing valve
- De-energize the auxiliary heat outputs
- Control the Y2 Out terminal based on operating conditions
- Reset and restart the 40-minute defrost inhibit timer

**TABLE 9:** Defrost Initiate Curves

Defrost Curve Selection Jumper Position	1	2	3	4
Heat Pump Model	2-Ton 2.5-Ton	4-Ton 5-Ton	3-Ton 3.5-Ton	1.5-Ton

**FIGURE 10:** Defrost Operation Curves

## COOLING OPERATION

During cooling operation, the control will receive thermostat signals at the Y1 and O input terminals. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also closes the outdoor fan relay delivering power to the ODF terminal causing the outdoor fan to operate. The control energizes the RV terminal with 24VAC to switch the reversing valve. Additionally, the Y2 Out terminal is energized with 24 VAC. This signal can be used to signal the indoor unit to deliver high airflow.

## HEATING OPERATION

During normal heating mode, the control will receive a thermostat signal at the Y1 input terminal. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also closes the outdoor fan relay delivering power to the ODF terminal causing the outdoor fan to operate. The reversing valve is not energized in heating mode. If the Y2 terminal of the control is energized when the Y1 terminal is not energized, the control will display and store a fault code and will not energize the compressor.

### Conventional Heat Pump Mode

The factory setting of the HOT HEAT PUMP jumper on the control is the OFF position. In this configuration the heat pump operates in conventional heat pump mode. If the jumper is not in place, the control will act as if the jumper is in the OFF position.

If the HOT HEAT PUMP jumper is in the OFF position, the control will energize the Y2 Out terminal whenever the compressor is running.

The location of the hot heat pump jumper is shown in Figures 10 and 13.

### Hot Heat Pump Mode (With Variable Speed Blower)

The control will operate in Hot Heat Pump Mode only if the HOT HEAT PUMP jumper on the control is placed in the ON position. The Y2 Out signal must also be connected to the indoor unit.

The SWITCH POINT jumper on the control has no effect on the operation of the heat pump.

The control implements the Hot Heat Pump Mode by controlling the indoor airflow level during heating operation only. Cooling operation is not affected. By reducing the indoor airflow level, the heat pump system will operate with increased indoor discharge air temperatures. The control changes the indoor airflow level using the Y2 Out signal. This terminal is connected to the high speed cooling input of a variable speed indoor unit. When the heat pump control energizes the Y2 Out terminal, the indoor blower runs at high speed delivering high airflow. When the control de-energizes the Y2 Out terminal, the indoor blower runs at a lower speed delivering lower airflow.

If the HOT HP jumper is in the ON position and the control receives a call for heating (Y1), the control will energize the compressor and measure the outdoor ambient temperature.

If the outdoor ambient temperature is equal to or greater than 50F, the control will energize Y2Out and keep it energized until the thermostat is satisfied (Y1 signal removed). The higher airflow is required to keep the operating pressures low when the outdoor ambient temperature is 50F or greater.

If the outdoor ambient temperature is less than 50F, the control will start a ten-minute timer and keep Y2 Out de-energized. Therefore, the compressor will be operating and the indoor unit will be operating with reduced airflow. **If the HOT HP jumper is in the ON position and if the outdoor ambient temperature is less than 50F, the indoor airflow at the beginning of a heating cycle will always be low.**

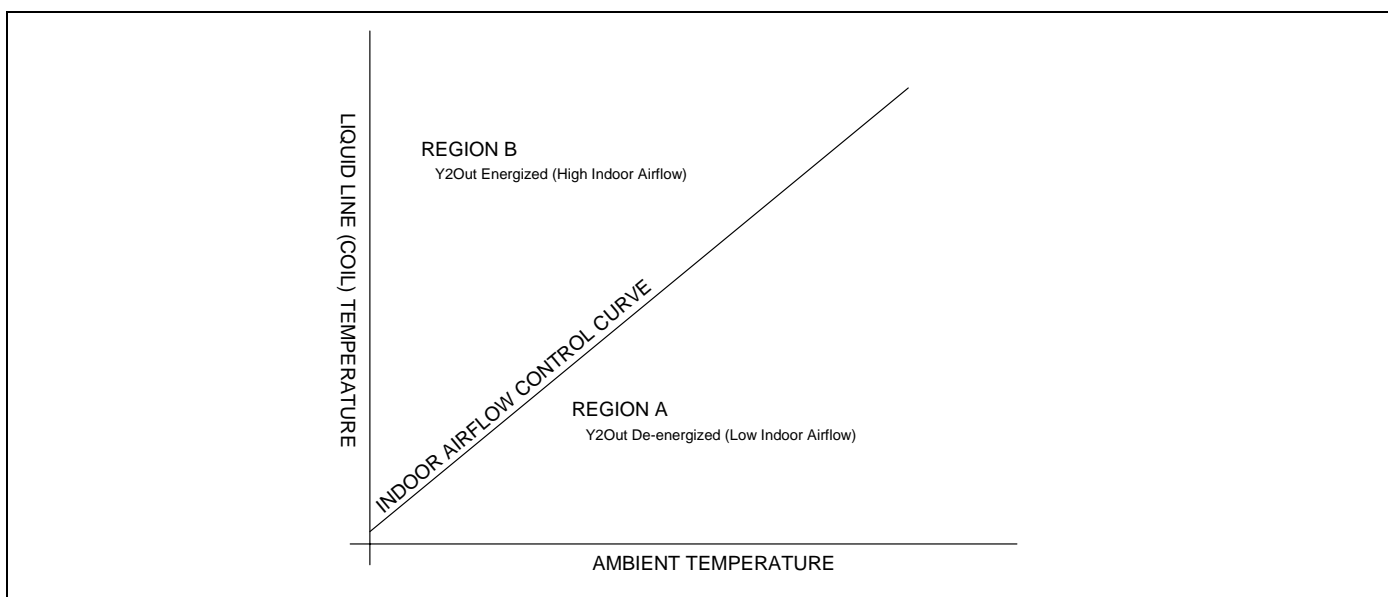
When the ten-minute timer expires, the control will measure the liquid line temperature and determine whether to energize Y2 Out and increase the indoor airflow or keep Y2 Out de-energized and maintain reduced indoor airflow. The control compares the measured liquid line temperature to a pre-programmed indoor airflow curve. It continues to keep Y2Out de-energized until the liquid line temperature exceeds the curve for the given outdoor ambient temperature continually for 30 seconds. If the liquid line temperature drops below the curve, the control will reset the 30-second timer and restart it when the liquid line temperature again exceeds the curve. When the liquid line temperature exceeds the indoor airflow control curve continually for 30 seconds, the control will energize Y2Out, i.e. cause high indoor airflow, until the thermostat demand is satisfied and the thermostat signal inputs are removed. Figure 12 describes the required behavior.

Once the control energizes Y2 Out to create high airflow, it will keep Y2 Out energized until the thermostat is satisfied and the call for heating is removed. It will do this regardless of a change in outdoor ambient or liquid line temperature. Therefore, if the control energizes Y2 Out because the outdoor ambient temperature is greater than or equal to 50F or because the liquid line temperature exceeds the curve for the given outdoor ambient temperature (point within region B), it will keep Y2 Out energized until the thermostat is satisfied even if the liquid line or outdoor ambient temperature falls below the curve (point within region A).

The control of Y2 Out to generate high indoor airflow as required will prevent the heat pump system pressures and temperatures from becoming too great when the compressor is running at full capacity with low indoor airflow.

As an example, assume that the HOT HP jumper is in the ON position. When the control receives a call for heating (Y1), it checks the outdoor ambient temperature. If the outdoor ambient temperature is 52F, the control will energize Y2 Out immediately causing high indoor airflow and keep it energized until the Y1 signal is removed. If the outdoor ambient temperature is 48F, the control will maintain Y2 OUT in a de-energized state and begin a ten-minute timer. The indoor unit will be running at low airflow because of the Y1 signal being delivered to the Y1 input of the indoor unit.

When the ten-minute timer expires, the control will compare the liquid line temperature to the indoor airflow control curve for the measured outdoor ambient temperature. If the point is within region A (See Figure 12), the control shall maintain Y2 OUT in the de-energized state until the liquid line temperature rises so that region B is entered. While in region A, the indoor unit will continue to run at low airflow. When the liquid line temperature point enters region B, the control will start a 30 second timer. When the timer expires, the control will immediately energize Y2 OUT. If the liquid line temperature drops back into region A before the timer expires, the control will reset the timer and restart it when the liquid line temperature again enters region B. When the liquid line temperature is in region B continually for thirty seconds, the Y2 Out signal will be delivered to the indoor unit and cause high indoor airflow.



**FIGURE 11:** Hot Heat Pump Indoor Airflow Control

During defrost operation, the control will ignore the HOT HP jumper setting and energize the Y2 Out signal to create high indoor airflow. Additionally, if at any point the conditions require a defrost cycle, the control will override the reduced indoor airflow feature and function based on the defrost requirements and conditions.

## EMERGENCY HEAT

When the control receives a W signal without a Y signal (emergency heat), the control will de-energize the compressor and energize the W1 Out and W2 Out terminals immediately. The balance point setting is ignored during a call for emergency heat. Therefore, W1 Out and W2 Out will be energized regardless of the outdoor ambient temperature.

## JUMPER INPUTS

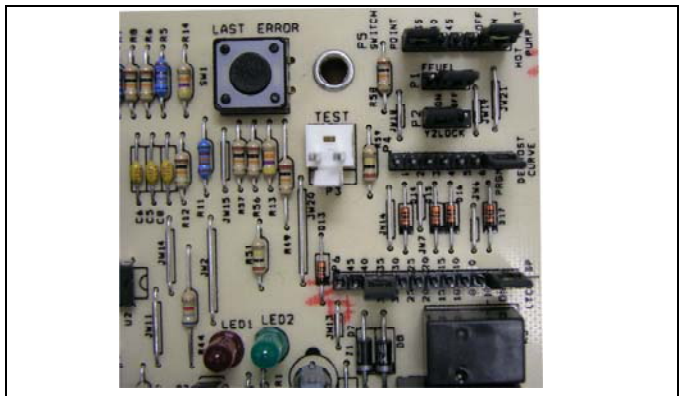
The control uses seven jumpers to determine how the heat pump should operate. These jumpers are shown in Figures 10 and 13. The jumpers that affect this heat pump are the following. The effects of these jumper settings on the operation of the heat pump are described in other sections of this document.

- LTCO – Low Temperature Cutout
- BP – Balance Point
- Defrost Curve
- FFUEL – Specifies fossil fuel furnace application
- HOT HEAT PUMP – Enables indoor airflow control for hot heat pump application

The two jumpers that do not affect the operation of this heat pump are Y2 LOCK and SWITCH POINT. Both of these jumpers apply only to two-stage compressor units.

The control only reads the jumper inputs when the Y1, Y2, and W thermostat inputs are de-energized. If a jumper position is changed while any of these inputs are energized, the control will not act upon the jumper changes until all three of these thermostat calls are de-energized or power (24 VAC) to the control is cycled.

**IMPORTANT:** Changes to the jumper inputs do not take affect until Y1, Y2, and W thermostat signals are de-energized.



**FIGURE 12:** Jumper Inputs

## LOW TEMPERATURE CUTOUT (LTCO) AND BALANCE POINT (BP)

The control includes a low temperature cutout (LTCO) feature that prevents compressor operation below a specified temperature during heat pump heating operation only. The LTCO setting does not apply to compressor operation during cooling or defrost operation.

The control also includes a balance point feature that prevents the operation of auxiliary heat above a specified temperature.

### Setting

The LTCO and BP jumpers on the control are shown in Figures 10 and 13. Both jumpers are placed on the same connector. The control will consider the lowest jumper pin setting to be the LTCO and the highest jumper pin setting to be the BP. The use of the same connector forces the BP and the LTCO to always be separated by at least 10 degrees.

The temperatures shown on the side of the connector labeled LTCO are the LTCO temperature options. The values shown are in degrees F. The control allows the LTCO to be set to any of the following temperatures: -10, 0, 10, 15, 20, 25, 30, 35 degrees F or ON. Placing the jumper in the ON position will allow the control to operate the compressor at any temperature during heating operation.

The factory places the LTCO jumper in the ON position. The jumper must be changed in the field to implement the LTCO feature. If the jumper is removed, the control will behave as if the jumper is in the ON position.

The temperatures shown on the side of the connector labeled BP are the BP temperature options. The values are shown in degrees F. The control allows the balance point to be set to any of the following temperatures: 0, 10, 15, 20, 25, 30, 35, 40, or 45 degrees F.

The factory places the BP jumper in the 35 F position. The jumper may be changed in the field as desired. If the jumper is removed, the control will behave as if the jumper is in the 35 position.

If only one jumper is in place, the control will set the balance point based on the jumper position and will set the LTCO to ON. If only one jumper is in place and it is below the valid BP settings (in the -10 or ON position), the control will set the BP to the default value for no jumper in place (35F) and set the LTCO based on the jumper position (-10 or ON).

## Low Temperature Cutout (LTCO) Operation

The control will not operate the compressor in heating mode when the outdoor ambient temperature is below the selected LTCO. The LTCO applies only to air handler mode operation. In fossil fuel mode the balance point (BP) restricts the operation of the compressor so the LTCO setting has no effect.

## Balance Point (BP) Operation

If the measured outdoor ambient temperature is greater than the balance point setting, the control will not energize the auxiliary heat outputs. However, the control shall ignore the balance point setting and energize auxiliary heat under some conditions as described in the auxiliary heat sections of this document.

## FOSSIL FUEL JUMPER (FFUEL)

### Setting

The control includes a FFUEL jumper to specify whether the control is installed with a fossil fuel furnace or an air handler (electric heat). This jumper is shown in Figures 10 and 13. The factory places the FFUEL jumper in the OFF position which is the correct position for an air handler installation. The jumper must be changed to the ON position in the field if the heat pump is installed with a fossil fuel furnace. If the jumper is removed, the control will behave as if the jumper is in the OFF position.

**IMPORTANT:** If the heat pump is being installed with a fossil fuel furnace, the FFUEL jumper must be placed in the ON position during installation for proper system operation.

### Operation

The control operates the auxiliary heat outputs, W1 Out and W2 Out, based on the position of the FFUEL jumper. If the FFUEL jumper is in the ON position, the control will function in fossil fuel mode. If the jumper is in the OFF position, the control will function in air handler mode. The FFUEL jumper has no effect on cooling operation.

## AUXILIARY HEAT - AIR HANDLER MODE

The heat pump control energizes the auxiliary electric heat in air handler mode using the W1 Out and W2 Out signals. The control receives the room thermostat call for auxiliary heat at the W input terminal.

### Standard Operation

If the outdoor ambient temperature is less than ten degrees F below the balance point setting and a W input is received with a Y1 input, the control will energize the M compressor contactor output based on the Y1 input and will energize the W1 Out immediately when the W input is received. When the W input is received, the control will start a fifteen-minute timer. If the call for Y1 + W is still present after the fifteen-minute timer expires, the control will then energize W2 Out along with W1 Out. If the W input is removed but the Y1 signal remains, the control will de-energize W1 Out and W2 Out (if energized) and reset and restart the timer. If the W input is received again without a loss of the Y1, the same functionality will be repeated.

If the outdoor ambient temperature is ten degrees F or more below the balance point setting and a W input is received with a Y1 input, the control will energize W1 Out and W2 Out immediately.

If the outdoor ambient temperature is below the low temperature cutout (LTCO) setting, the control will de-energize the compressor and energize W1 Out immediately when a Y1 input is received. If the outdoor ambient temperature rises above the LTCO setting before the thermostat is satisfied, the control will continue to keep the compressor outputs de-energized until the thermostat is satisfied. In other words, the control will use auxiliary heat to satisfy the thermostat demand and not turn the compressor back on even if the outdoor ambient temperature rises above the LTCO setting during a call for heating.

Table 10 describes the auxiliary heat operation for air handler mode.

**TABLE 10:** Air Handler Auxiliary Heat Functionality

Outdoor Ambient Temperature	CONTROL INPUTS		
	Y1	Y1 + W	W
Ambient above BP	Heat Pump Operation	Heat Pump Operation (then + W1 Out + W2 Out after pipe freeze protection timer expires)	W1 Out + W2 Out
Ambient below BP and above BP-10F	Heat Pump Operation	Heat Pump Operation + W1 Out (immediate) + W2 Out (after 15 minutes)	W1 Out + W2 Out
Ambient below BP-10F and above LTCO	Heat Pump Operation	Heat Pump Operation + W1 Out (immediate) + W2 Out (immediate)	W1 Out + W2 Out
Ambient below LTCO	W1 Out	W1 Out + W2 Out	W1 Out + W2 Out

### Auxiliary Heat Defrost Operation – Air Handler Mode

The control will energize W1 Out and W2 Out 45 seconds prior to and during defrost operation. If a call for heating (Y1) is still present after the defrost cycle has terminated, the control will continue to energize W1 Out and W2 Out for 180 seconds after the defrost cycle has been terminated. The control will begin normal heat pump heating mode operation upon termination of the defrost cycle.

### Pipe Freeze Protection Timer – Air Handler Mode Operation

The control starts a four hour timer when a call for compressor operation and auxiliary heat (Y1 + W) is received. If the call for compressor operation and auxiliary heat is still present after the timer expires, the control will energize W1 Out and W2 Out in addition to the compressor output regardless of the balance point setting. If the call for auxiliary heat (W) is removed but the call for compressor operation (Y1) remains, the control will de-energize auxiliary heat (W1 Out and W2 Out) and reset and restart the timer. If the timer expires again, the same functionality will be repeated indefinitely. The purpose of this feature is to prevent the pipes in a home from freezing if the balance point is set too low and the heat pump cannot heat the home using compressor operation only. This will be a benefit if a home is not occupied and a compressor problem occurs. The control shall also store and display a fault flash code when the pipe freeze timer has expired.

**TABLE 11:** Fossil Fuel Furnace Auxiliary Heat Functionality

Outdoor Ambient Temperature	CONTROL INPUTS		
	Y1	Y1 + W	W
Ambient above BP	Heat Pump Operation	Heat Pump Operation (then W1 Out + W2 Out after pipe freeze protection timer expires)	W1 Out + W2 Out
Ambient below BP	W1 Out	W1 Out + W2 Out	W1 Out + W2 Out

### Bonnet Sensor – Fossil Fuel Mode

The heat pump may be equipped in the field with an optional indoor air discharge temperature or bonnet sensor. The control does not allow the heat pump and the furnace to operate simultaneously even with a bonnet sensor installed except surrounding a defrost cycle. The control cycles the fossil fuel furnace differently surrounding a defrost cycle depending on whether a bonnet sensor is installed.

The bonnet sensor is installed in the indoor unit and is mounted so that it measures the indoor air temperature after the air exits the furnace. The bonnet sensor is connected to the heat pump control using the BS and BSG terminals. Refer to the bonnet sensor accessory kit for complete installation instructions.

The bonnet sensor only applies to fossil fuel furnace applications and should not be installed with air handlers. If the bonnet sensor is present and the control is set to air handler mode, the indoor unit might be a furnace and the operation mode is incorrectly specified. The control will operate in fossil fuel mode instead of air handler mode so that the furnace and heat pump are not operated simultaneously.

### AUXILIARY HEAT - FOSSIL FUEL MODE

#### Standard Operation

The LTCO does not have any impact on the operation of auxiliary heat when the control is in fossil fuel mode. Since the compressor is not allowed to come on below the balance point and the balance point is always above the LTCO, the balance point setting effectively becomes the LTCO setting. This is done intentionally to allow the balance point to function as an economic balance point based on the cost of heating with electricity (above the balance point) versus heating with fossil fuel (below the balance point).

If the measured outdoor ambient temperature is below the balance point setting, the control will de-energize compressor outputs and energize W1 Out immediately when the Y1 input is received. If the outdoor ambient temperature rises above the balance point setting before the thermostat is satisfied, the control will continue to keep the compressor outputs de-energized until the thermostat is satisfied. In other words, the control will use furnace to satisfy the thermostat demand and not turn the compressor back on even if the outdoor ambient temperature rises above the LTCO setting during the call for heating.

If a W input is received with or without a Y1 input, the control will de-energize the compressor outputs and energize W1 Out and W2 Out immediately.

Table 11 describes the auxiliary heat operation for fossil fuel mode.

Since the bonnet sensor is an optional accessory, the control cannot detect a bonnet sensor that fails in the open position. If the control senses that the bonnet sensor thermistor is open, it will assume that a bonnet sensor thermistor is not connected and will function without implementing the optional bonnet sensor features. If the control senses that the bonnet sensor thermistor is shorted, it will cause a lockout condition and store and display the appropriate error code.

If the control is in air handler mode and detects that a bonnet sensor input is present, it will control W1 Out and W2 Out as required by the fossil fuel mode. It will also cause a fault code to be displayed on the thermostat via the X/L output to notify the homeowner that there is a problem even though the system is operating.

### Auxiliary Heat Defrost Operation – Fossil Fuel Mode with Bonnet Sensor

With a bonnet sensor present the control will energize W1 Out and W2 Out 45 seconds prior to the initiation of the defrost cycle.

During defrost operation, if the bonnet sensor input reaches 109F, the control will de-energize W1Out and W2Out. The control will re-energize W1Out and W2Out when the bonnet sensor input drops below 90F again and the defrost cycle is still in process.

If a call for heating (Y1) is still present after the defrost cycle has terminated, the control will continue to energize W1 Out and W2 Out after the defrost cycle has been terminated until the bonnet sensor reaches 109F. When the bonnet sensor reaches 109F after the defrost cycle has terminated, the control will de-energize W1 Out and W2 Out and will not re-energize them during this call for heat. That is, once the defrost cycle has terminated, the control will not cycle W1 Out and W2 Out with the bonnet sensor.

The control will begin normal heat pump heating mode operation upon termination of the defrost cycle.

### Auxiliary Heat Defrost Operation – Fossil Fuel Mode without Bonnet Sensor

If the control is in fossil fuel mode and senses that no bonnet sensor is present, it will energize W1 Out and W2 Out immediately when the defrost cycle is initiated. If a call for heating (Y1) is still present after the defrost cycle has terminated, the control will de-energize W1 Out and W2 Out immediately and return to normal heat pump mode operation.

In this mode the control will energize the fossil fuel furnace only during defrost and not provide any comfort enhancements during the transition. The heat pump and furnace will not operate at the same time if the bonnet sensor is not in place.

### Pipe Freeze Protection Timer – Fossil Fuel Mode Operation

The control starts a four hour timer when a call for compressor operation and auxiliary heat (Y1 + W) is received. If the outdoor temperature is above the balance point, the control will energize the compressor instead of the auxiliary heat outputs. If the call for compressor operation and auxiliary heat is still present after the timer expires, the control will energize W1 Out and W2 Out and de-energize the compressor regardless of the balance point setting. The control will keep the W1 Out and W2 Out signals energized until the Y1 signal is removed. That is, the control will lock into auxiliary heat furnace operation until the room thermostat is satisfied. The purpose of this feature is to prevent the pipes in a home from freezing if the balance point is set too low and the heat pump cannot heat the home using compressor operation only. This will be a benefit if a home is not occupied and a compressor problem occurs. The control will also store and display a fault flash code when the pipe freeze timer has expired.

### HIGH-PRESSURE SWITCH FAULT

The heat pump is equipped with a high-pressure switch that is connected to the control at the HPS terminals. If the high-pressure switch opens for more than 40 milliseconds, the control will de-energize the compressor and store and display the appropriate fault code. If the pressure switch closes and a thermostat call for compressor operation is present, the control will apply the five-minute anti-short cycle delay timer and start the compressor when the timer expires.

When the compressor is started following a high-pressure switch fault, the control will start a six-hour timer based on accumulated compressor run time. If the control senses another opening of the high-pressure switch before the timer expires, it will cause a soft lockout condition. The second opening of the high-pressure switch must be greater than 160 milliseconds for the lockout to occur. If the second opening is between 40 and 160 milliseconds, the control will de-energize the compressor but not cause a soft lockout condition. If the control does not sense a second high-pressure switch opening before the six-hour timer expires, the timer and counter will be reset.

### LOW-PRESSURE SWITCH

The heat pump is equipped with a low-pressure switch which is connected to the control at the LPS terminals. If the low-pressure switch opens for more than five seconds, the control will cause a soft lockout condition and display the appropriate fault codes. However, the control will ignore the low pressure switch input and not cause a soft lockout condition if it opens during the following conditions.

- Defrost operation
- First two minutes of compressor operation
- Two minutes following the completion of a defrost cycle
- TEST input shorted with Y1 input energized

### DISCHARGE LINE TEMPERATURE SENSOR (OPTIONAL)

The heat pump may be equipped with an optional discharge line temperature sensor. If a discharge sensor is present, the control will provide the following features.

#### High Discharge Line Temperature

If the control senses a discharge line temperature reading of 263F for 30 seconds continually, it will cause a soft lockout condition. If the discharge line temperature drops below 263F during the 30-second timer, the control will reset the 30-second timer and restart the timer if the discharge line temperature again exceeds 263F.

#### Low Discharge Line Temperature

The control will begin a sixty-minute timer when either of the following conditions are met.

- The discharge line temperature has not reached 90F after eight minutes of accumulated compressor run time.
- The discharge temperature has not reached 90F after fifteen minutes of accumulated compressor run time following the exit of a defrost cycle.

If the discharge line temperature has not reached 90F after the sixty-minute timer has expired, the control will cause a soft lockout condition. The control will reset the sixty-minute timer upon expiration and when the compressor starts. The timer is reset when the compressor starts and is only restarted if one of the two conditions shown above are met.

The low discharge temperature fault indicates that the outdoor coil is too cold during heating operation. The lockout is intended to prevent refrigerant flooding back to the compressor.

**IMPORTANT: The discharge sensor must be well insulated and installed properly to prevent nuisance lockouts from occurring.**

### INDICATIONS OF PROPER OPERATION

#### Cooling

Cooling operation is the same as any conventional air conditioning unit.

1. The outdoor fan should be running, with warm air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging cool air from the ducts. Coils or other parts in the air circuit should be cleaned as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
3. The vapor line at the outdoor unit will feel cool to the touch.
4. The liquid line at the outdoor unit will feel warm to the touch.

#### Heating

Indications of proper Heating operation is as follows:

1. The outdoor fan should be running, with cool air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging warm air from the ducts.
3. The vapor line at the outdoor unit will feel warm to the touch.
4. The liquid line at the outdoor unit will feel cool to the touch.

## SECTION IX: INSTRUCTING THE OWNER

Assist owner with processing warranty cards and/or online registration. Review Owners Guide and provide a copy to the owner and guidance on proper operation and maintenance. Instruct the owner or the operator how to start, stop and adjust temperature setting.

When applicable, instruct the owner that the compressor is equipped with a crankcase heater to prevent the migration of refrigerant to the compressor during the "OFF" cycle. The heater is energized only when the unit is not running. If the main switch is disconnected for long periods of shut down, do not attempt to start the unit until 8 hours after the switch has been connected. This will allow sufficient time for all liquid refrigerant to be driven out of the compressor.

The installer should also instruct the owner on proper operation and maintenance of all other system components.

### MAINTENANCE

1. Dirt should not be allowed to accumulate on the outdoor coils or other parts in the air circuit. Clean as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
2. The outdoor fan motor is permanently lubricated and does not require periodic oiling.
3. If the coil needs to be cleaned, it should be washed with Calgon Coilclean (mix one part Coilclean to seven parts water). Allow solution to remain on coil for 30 minutes before rinsing with clean water. Solution should not be permitted to come in contact with painted surfaces.
4. Refer to the furnace or air handler instructions for filter and blower motor maintenance.
5. The indoor coil and drain pan should be inspected and cleaned regularly to prevent odors and assure proper drainage.

### CAUTION

*IT IS UNLAWFUL TO KNOWINGLY VENT, RELEASE OR DISCHARGE REFRIGERANT INTO THE OPEN AIR DURING REPAIR, SERVICE, MAINTENANCE OR THE FINAL DISPOSAL OF THIS UNIT.*

*WHEN THE SYSTEM IS FUNCTIONING PROPERLY AND THE OWNER HAS BEEN FULLY INSTRUCTED, SECURE THE OWNER'S APPROVAL.*

**TABLE 12: 1-1/2 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	132 (8)	133 (8)	135 (8)	137 (9)
70	146 (9)	147 (9)	149 (9)	152 (10)
75	160 (10)	161 (10)	164 (10)	166 (10)
80	174 (10)	175 (10)	178 (10)	180 (11)
85	188 (10)	189 (10)	192 (10)	194 (11)
90	202 (10)	203 (10)	206 (10)	208 (11)
95	217 (9)	217 (10)	220 (10)	223 (10)
100	234 (10)	235 (10)	238 (10)	241 (11)
105	252 (10)	253 (10)	256 (11)	259 (11)
110	270 (11)	271 (11)	274 (11)	277 (11)
115	288 (10)	289 (10)	292 (11)	295 (11)
120	305 (10)	307 (10)	310 (10)	313 (10)
125	323 (10)	325 (9)	328 (10)	331 (10)

**TABLE 13: 2 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	143 (7)	144 (8)	146 (7)	149 (8)
70	158 (8)	159 (9)	161 (9)	165 (9)
75	173 (9)	174 (10)	176 (10)	180 (10)
80	187 (10)	190 (10)	191 (10)	195 (10)
85	202 (10)	205 (10)	206 (11)	210 (11)
90	217 (10)	220 (10)	221 (11)	226 (11)
95	232 (9)	235 (10)	237 (10)	241 (10)
100	252 (10)	254 (11)	256 (11)	260 (11)
105	271 (11)	273 (11)	275 (11)	279 (11)
110	291 (11)	292 (11)	294 (11)	298 (11)
115	310 (11)	312 (11)	313 (11)	318 (11)
120	330 (11)	331 (10)	332 (11)	337 (11)
125	349 (10)	350 (10)	351 (10)	356 (11)

**TABLE 14: 2-1/2 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	133 (9)	134 (9)	135 (9)	135 (9)
70	147 (10)	149 (10)	149 (10)	150 (11)
75	162 (11)	163 (11)	164 (11)	165 (11)
80	176 (11)	177 (11)	178 (11)	180 (12)
85	191 (11)	192 (11)	192 (11)	194 (12)
90	205 (11)	206 (11)	207 (11)	209 (12)
95	220 (11)	220 (11)	221 (11)	224 (11)
100	238 (11)	238 (11)	239 (11)	242 (12)
105	256 (12)	256 (11)	257 (12)	260 (12)
110	274 (12)	274 (11)	275 (12)	278 (12)
115	292 (11)	292 (11)	294 (12)	296 (12)
120	311 (11)	310 (11)	312 (11)	315 (12)
125	329 (10)	328 (10)	330 (11)	333 (11)

**TABLE 15: 3 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	130 (3)	130 (2)	133 (3)	135 (3)
70	144 (4)	144 (4)	147 (4)	149 (4)
75	158 (4)	158 (4)	161 (5)	163 (4)
80	172 (5)	172 (5)	175 (5)	177 (5)
85	186 (5)	186 (5)	189 (5)	191 (5)
90	200 (5)	200 (5)	203 (5)	205 (5)
95	213 (4)	213 (4)	217 (4)	219 (5)
100	231 (5)	231 (5)	234 (5)	236 (5)
105	248 (5)	248 (5)	251 (5)	253 (6)
110	266 (5)	265 (5)	268 (6)	271 (6)
115	283 (5)	283 (5)	285 (6)	288 (6)
120	301 (5)	300 (4)	303 (5)	305 (5)
125	318 (4)	318 (4)	320 (5)	323 (5)

**TABLE 16: 3-1/2 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	139 (7)	139 (7)	139 (7)	140 (6)
70	154 (8)	154 (8)	154 (8)	155 (7)
75	169 (9)	169 (9)	169 (9)	170 (8)
80	184 (10)	184 (9)	184 (9)	185 (9)
85	199 (10)	199 (10)	199 (9)	200 (9)
90	213 (10)	214 (10)	214 (9)	215 (9)
95	228 (9)	229 (9)	229 (9)	230 (9)
100	247 (10)	248 (10)	248 (10)	249 (10)
105	267 (11)	268 (11)	267 (11)	269 (11)
110	286 (11)	287 (11)	286 (11)	288 (11)
115	305 (11)	306 (11)	305 (11)	307 (11)
120	324 (10)	326 (11)	324 (11)	326 (11)
125	344 (10)	345 (10)	343 (11)	346 (11)

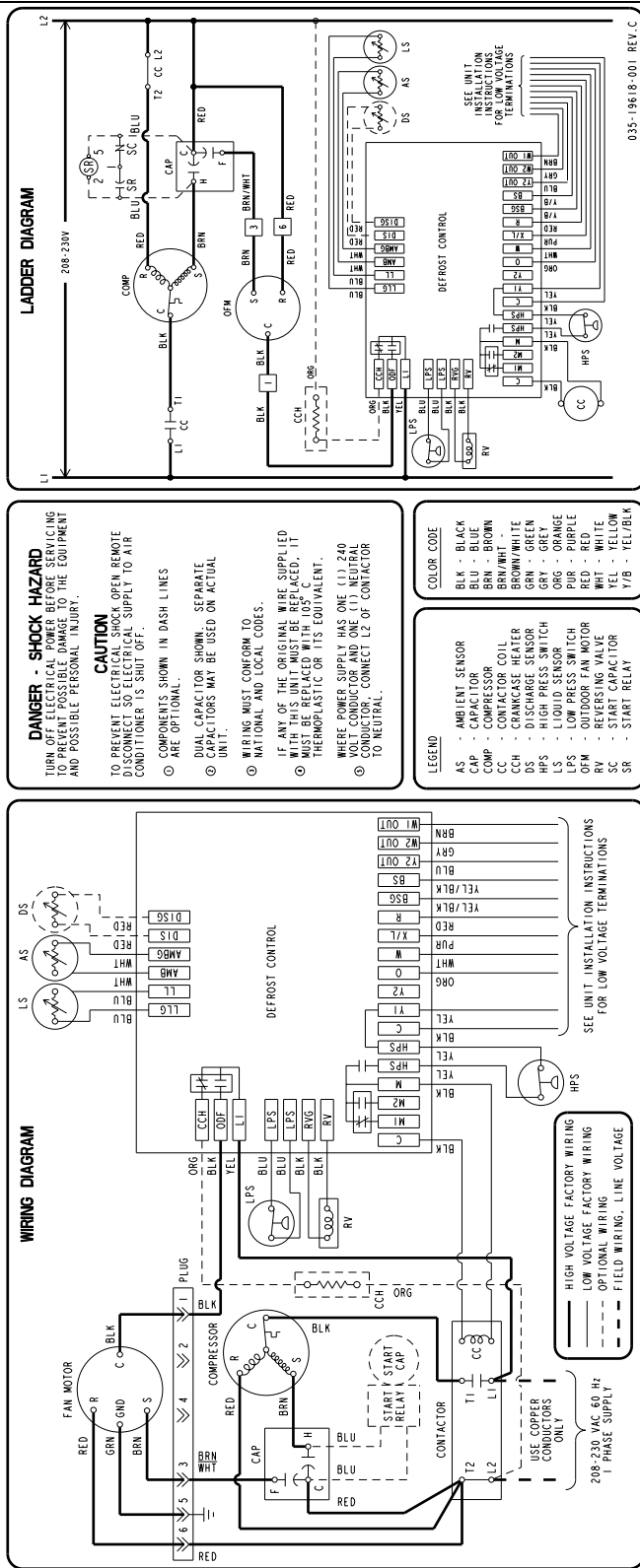
**TABLE 17: 4 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	141 (4)	140 (3)	141 (3)	142 (2)
70	155 (5)	154 (4)	156 (4)	157 (3)
75	169 (5)	169 (5)	171 (4)	172 (4)
80	183 (5)	183 (5)	185 (5)	187 (4)
85	197 (5)	198 (5)	200 (5)	202 (4)
90	211 (5)	212 (5)	214 (4)	217 (4)
95	225 (4)	226 (4)	229 (4)	232 (4)
100	243 (4)	244 (5)	247 (4)	250 (4)
105	262 (5)	262 (5)	265 (5)	268 (5)
110	280 (5)	280 (5)	283 (5)	286 (5)
115	298 (4)	298 (5)	301 (5)	304 (5)
120	316 (4)	316 (4)	319 (4)	323 (4)
125	334 (3)	334 (4)	337 (4)	341 (4)

**TABLE 18: 5 Ton Subcooling Charging Chart**

Outdoor Ambient	Indoor Wet Bulb (°F)			
	57	62	67	72
DB (°F)	Liquid Pressure (psig) at Base Valve			
65	141 (7)	140 (7)	143 (6)	146 (6)
70	156 (8)	156 (8)	158 (7)	161 (7)
75	171 (9)	171 (8)	173 (8)	177 (8)
80	185 (9)	186 (9)	189 (8)	192 (9)
85	200 (9)	201 (9)	204 (8)	208 (9)
90	214 (9)	216 (9)	219 (8)	223 (9)
95	229 (9)	231 (8)	234 (8)	238 (8)
100	248 (9)	250 (9)	253 (8)	257 (9)
105	266 (9)	269 (9)	272 (9)	276 (9)
110	285 (9)	288 (9)	291 (9)	294 (9)
115	304 (9)	307 (9)	309 (8)	313 (9)
120	323 (9)	326 (9)	328 (8)	331 (8)
125	341 (8)	345 (8)	347 (7)	350 (7)

## SECTION X: WIRING DIAGRAM



**FIGURE 13: Wiring Diagram**

Subject to change without notice. Printed in U.S.A.  
Copyright © by York International Corp. 2006. All rights reserved.

170761-UIM-B-0406  
Supersedes: 170761-UIM-A-0106

Unitary Product Group

**5005  
York  
Drive**

**Norman  
OK  
73069**